# ASSESSMENT OF FACTORS LEADING TO POOR ELECTRONICS WASTE MANAGEMENT IN ARUSHA CITY, TANZANIA

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF ENVIRONMENTAL MANAGEMENT STUDIES OF THE OPEN UNIVERSITY OF TANZANIA**

**2017**

## CERTIFICATION

The undersigned certifies that has read and hereby recommends for acceptance by the Open University of Tanzania, a dissertation title *"**Assessment of Factors Leading to Poor Electronics Waste Management in Arusha City, Tanzania"*** in partial fulfillment of the requirements for the degree of Master of **Environmental Management Studies of The Open University of Tanzania.**

……

**Dr. Joseph Magali**

**(Supervisor)**

……

Date

## COPYRIGHT

## DECLARATION

**I, Rehema Elias Koka,** do hereby declare that this dissertation is my own work and it has not been submitted for any academic award in any university for similar or any other degree award.

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Signature

……..

Date

## DEDICATION

This work is dedicated to the **Almighty God,** the creator and giver of life to every living, the source of all wisdom and inspiration and the One who said “Let the water under sky be gathered to one place” and so it was! (Genesis 1:1-31).

To my beloved parents, my father the late Rev. Canon Alfeji Timbuka, my mother the late Mrs.Phillys Alfeji Timbuka, lastly my lovely husband Elias Koka and children Kelvin Koka, Careen Koka and Kenneth Koka.

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## ABSTRACT

The study sought out to examine factors leading to poor electronic waste management in Arusha City, Tanzania. The study was guided by four objectives: to analyze the influence of policies and regulations on e-waste management, explain the influence of e-waste handling technology on e-waste management, to analyze the influence of human and financial resources on e-waste management, and explain the role of e-waste disposal education on e- waste management so as to suggest best approaches that will safeguard health of human beings and environment. The sample size constituted of 120 respondents, where by 40 respondents were Government and private Institutions, 40 respondents were Electrical and Electric Equipment artisans and 40 respondents were ordinary residents (households).The study used survey design. The questionnaire was the main instruments for data collection. Statistical Package for Social scientists (SPSS Version 22) was used to analyze data. The study reveals that poor enforcement of policy and regulations, lack of technology, absence of human and financial resources and lack of awareness on the importance of proper management of e-waste affects the management of e-waste in the study area. The study recommends that e-waste should be sorted to ensure that they are not mixed with other wastes, policy and regulation regarding e-waste management should be enforced. The government should guide citizens to control quality of electronic products during importation and ensure that education and training should be given to the community and all stakeholders on the effects of e-waste products. Also e-waste recycling industries should be established and lastly but not least every stakeholder should set a budget which will be used to finance the e-waste management activities.

## LIST OF ABBREVIATIONS

| | |
|---|---|
| CRT | Cathode ray tubes |
| EEE | Electrical and Electric Equipment |
| EoL | End-of-life |
| EPA | Environmental Protection Agency |
| EPR | Extended producer responsibility |
| ICT | Information and Communication Technology |
| LCA | Life Cycle Assessment |
| MCA | Multi Criteria Analysis |
| MFA | Material Flow Analysis |
| PCDDs | Polychlorinated dibenzo-p-dioxins |
| PCDFs | Polybrominated diphenyl |
| SWOT | Strengths , Weaknesses, Opportunities and Threats |
| TCRA | Tanzania Communication Regulatory Authority |
| US EPA | United States Environmental Protection Agency |

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# CHAPTER ONE

# 1.0 INTRODUCTION

## 1.1 Background Information

Various conducted studies assert that there are challenges associated with e-waste management in different countries, despite the studies expose that developed countries have relatively good e-waste management compared to developing countries. According to Jerie and Tevera (2014) in Zimbabwe the existing e-waste management does not indicate the sustainable practices because of lack of finance, inadequate skills and lack of environmental sound disposal management. Disposal management education and availability of funds for waste disposal are important for disposing various wastes in urban Ghana (Issahaku et al, 2014).

Similarly, Schluep et al (2009) noted that inadequate financing, unfavorable policies and legislations, lack of skills and poor technology were the barriers hindering sustainable e-waste management and technologies for recycling in India, China, South Africa, Morocco, Colombia, Mexico and Brazil.

Studies done worldwide signify that the government has essential role of promoting the e-waste management. Ylä-Mella et al (2014) emphasized the role of waste disposal policies and legislations in Scandinavian countries (Finland, Sweden and Norway). The role of regulation in facilitating e-waste management also was confirmed by Suja et al (2014) who recognized the role of e-waste management in Malaysia.

The existing literatures show that there will be accumulation of e-waste in Tanzania in future. According to Magashi and Schluep (2011) in 2015 in Tanzania will be having about 9,500 tonnes of e- waste. However, currently there is no specific policy on e-waste management while also there are correct records on imported products which will be converted in e-waste in nearly future time. Magashi and Schluep (2011) also asserted that lack of facilities for e-waste disposal, weak regulations, inadequate public awareness on e-waste management and poor policies and regulations on e-waste management are problems associated with e-waste management in Tanzania.

Koloseni and Shimba (2012) argued that e-waste management in Tanzania are hindered by lack of proper policy on e-waste management, lack of strategies for e-waste management, lack of skilled personnel and poor recycling techniques for e-waste.

Similar weakness of e-waste management were noted by Mataheroe (2009) who stressed that lack of effective techniques for e-waste collection and disposal, inadequate skills and absence of legislation and policy on e-waste management, hinders e-waste management in Tanzania, particular in Dar es salaam city.

Arusha city is the largest city in Tanzania after Dar es Salaam. However, there is no information on problems of e-waste management like in Dar es Salaam as noted by Mataheroe (2009). Thus there is need to examine the factors that influence poor e-waste management and propose strategies for e-waste management.

## 1.2 Problem Statement

The continuous dependence on electronic equipment's in homes and at workplaces as well as rapid changes in technology, changes in media (tapes, software, etc), falling prices, and planned obsolescence has resulted in a fast-growing surplus of electronic waste around the globe. The average lifespan of a new model computer has decreased from 4.5 years in 1992 to an estimated 2 years in 2005 and is further decreasing and this has impacts on e-waste accumulation. The United Nations estimates that, collectively, the world generates 20-50 million tons of e-waste every year. The minimization or elimination of these e-wastes is now of greater concern to the world at large (Ibrahim et al, 2013). To date the problem of sanitation and disposal of solid waste, poor sewage system in urban areas has yet to be addressed to mitigate this waste menace (Mataheroe, 2009).

Lack of capacity for handling and recycling the hazardous materials contained in e-waste usually leads to the disposal of both e-waste and municipal wastes in the same dumpsites; thereby polluting the environment with heavy metals such as Cd, Pb, Hg, and chemicals like polychlorinated dibenzo-p-dioxins (PCDDs) and furans (PCDFs), polybrominated diphenyl ethers (PBDEs) and polycyclic aromatic hydrocarbons (PAHs) thereby creating health risks to the nearby community and the population at large. Thus improper management of e-wastes at the end of its useful life poses serious challenges to the existing solid waste management structures resulting in widespread contamination of the environment. Also, second hand and outdated electronic equipment from donors which are exported into developing countries in

the name of free trade are further complicating the problems associated with e- waste management (Ibrahim et al, 2013).

Tanzania is currently undergoing a rapid advancement in information and communication technology (ICT) which leads to waste accumulation while it has no effective strategies on e-waste management (Mataheroe 2009; Magashi and Schluep 2011; Koloseni and Shimba 2012). Arusha region being one of the largest City in Tanzania can't escape the e-waste accumulation problem. Therefore, this study is designed to assess the electronic waste management in Arusha City and suggest best approaches that will safe guard health of the society.

## 1.3 General objectives

The general objective of this study was to assess the factors leading to poor electronic waste management in Arusha.

## 1.4 Specific Objectives

The study was guided by the following specific objectives:

i) To analyze the influence of policies and regulations on e-waste management
ii) To explain the influence of e-waste handling technology on e-waste management
iii) To analyze the influence of Human and financial resources on e-waste management
iv) To explain the role of e-waste disposal education of e- waste management

### 1.3.1 Hypotheses of the Study

The study was guided by the following hypotheses:

i) Residents at Arusha city has high awareness on the hazards caused by electronic waste products in Arusha City.
ii) Disposing of electronic waste products is done according to the existing regulations.

## 1.4 Significance of the Study

This study will establish the presence of electronic wastes, the level of the problem and the amount of the e-wastes available in Arusha Municipality. The study will assist the policy makers to know the existing situation and come up with a better way of handling the electronic wastes to safeguard the health of human beings and the environment conservation. The findings also will be a basis for further research for academicians and scholars in the field of e-waste management.

## 1.5 The Study Structure

The study is organized as follows: chapter one covers the background of the research problem, statement of the problem, justification of the study, overall and specific research objectives, general and specific research questions. It also contains significance of the research study and the study's structure.

Chapter two contains literature review which describes the conceptual definitions of relevant terms, critical review of theories by different authors. It also includes empirical literature review, the study gaps and the conceptual framework.

Chapter three presents the description of study area, research design, survey population and sampling techniques. The chapter further includes methods of data

collection, data processing analysis, data validity and reliability, variables and measurement, research ethics considerations and the limitations of the study.

Chapter four presents and discuss the data based on the objectives of the study while chapter five covers the summary of findings, conclusion, recommendations and the direction for the future study.

# CHAPTER TWO

# 2.0 LITERATURE REVIEW

## 2.1 Definition of Terms

### 2.1.1 E-waste

Is a term used to cover almost all types of electrical and electronic equipment (EEE) that cannot be upgraded or repaired for re-use and finally enter the waste stream. Although e- waste is a general term it can be considered to cover televisions, computer, mobile phones, white goods (example. fridges, washing machines, dryers etc (Robison, 2009). Also it includes home entertainment and stereo systems, toys toasters, kettles –almost any household or business item with circuitry or electrical components with power or battery supply (Step-initiative, 2017).

Reparable and sometimes non-reparable-waste include e-electronics are parts of e-waste. These come from electronic equipment such as plastics, steel and copper. These wastes become hazardous if there are no recycling operations. Therefore, e-waste materials include are those for residual materials which is a current buyer dump them when finds that they can longer used or but these can be only useful if they are exposed to recycling technology (Issahaku et al, 2014).

According to Hicks et al (2005), electronic waste may be defined as discarded computers, office electronic equipment, entertainment device electronics, mobile phones, television sets and refrigerators. This definition includes used electronics which are destined for reuse, resale, salvage, recycling or disposal. Others define the

re-usable (Working and repairable electronics) and secondary scrap (copper, steel, plastic, etc) to be commodities, and reserve the term " waste " for residue or material which is dumped by the buyer rather than recycled, including residue from reuse and recycling operations. Because loads of surplus electronics are frequently commingled (good recyclable and non-recyclable), several public policy advocates apply the term " e- waste" broadly to all surplus electronics. Cathode Ray Tubes (CRT) are considered one of the hardest types to recycle. CRTs have relatively high concentration of lead and phosphorus (not to be confused with phosphorus) both of which are necessary for the display. The United States Environmental Protection Agency (EPA) includes discarded CRT monitors in its category of " hazardous household waste" but considers CRT that have been set aside for testing to be commodities if they are not discarded, speculatively accumulated, or left unprotected from weather and other damage.

According to Gaidajis et al (2013), electronic equipment and therefore e-waste are everywhere in our society. They are characterized by a complex chemical composition and difficulty in quantifying their flows at a local and international level. The pollution caused by their irregular management substantially degraded the environment mostly in poorer countries, receiving them for recycling and recovery of their valuable metals. As for the consequences on ecosystems, human health and environmental restoration of areas burdened by certain polluters generated by e-waste (e.g. Li and Sb), there are no sufficiently documented scientific studies. Motivated by the minimization of environmental effects caused by the generated e-waste, many technological changes have been effectuated.

### 2.1.2 E- Waste Management

Many e-wastes are hazardous since they contain toxic chemicals and materials such as lead, mercury, etc. The big challenge remains to third world countries including Tanzania because in spite of not having many electronic industries these countries import large volume of low grade electronic products which become waste in a short time while and still do not have proper disposal systems for electronic waste. Since e-Waste are hazardous and have complex composition, a highly technology and specialized systems is required to facilitate disposal while minimizing harm to humans and environment in general (Semiono, 2015).

Although Tanzania has a number of policies which aim at protecting the environment example the Environment policy (1997) and the sustainable industry policy but the country has no specific policy related to e-Waste management. However, there were some legislations and regulations such as the Environmental Management Act, Chapter 191 of the laws of Tanzania, the Environmental (Solid Waste Management) Regulations, 2009 and the Environmental Management (Hazardous Waste Control) Regulations, 2009. The good step made is TCRA has already sent the proposed for e-Waste management Policy to the Vice President's office (Semiono, 2015).

### 2.1.3 Hazardous Wastes

According to Ibrahim (2013), hazardous waste is a solid, liquid or powder waste which because of it is quality concentration or physical, chemical or infectious characteristics may pose a substantial present or potential hazard to human health or the environment when improperly treated, stored or disposed or otherwise

mismanaged or course or contribute to increase in mortality or an increase in irreversible or incapacitating illness. Waste is classified under two categories, hazardous and non-hazardous. It may be noted that the classification, in some instances, is made conveniently for purposes of management one, and where this is the case, it means that if some wastes, if not the majority, non-hazardous waste if not properly managed, can be hazardous. In this regard, hazardous waste is taken to mean a waste or combination of wastes which, because of their quantity, or concentration or physical, chemical or infectious characteristics may- cause, or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated stored, transported, disposed or otherwise managed.

### 2.1.4 Recycling

Recycling is the process by which materials otherwise destined for disposal are collected, reprocessed or remanufactured and re- used (US EPA, 1995).

## 2.2 Theoretical Literature Review

### 2.2.1 Resource Dependency Theory

According to Davis and Cobb (2009), resource dependence theory describes the dependence between resources. Implying that, no resource can stand itself and be able to fulfill the organization mission, goals, strategy or objectives. Indeed, there is a close linkage between the e-waste management and other resources such as human, financial and equipment. Since in order to implement e-waste management

effectively; the government needs the well-educated human resources, who will formulate proper policies on e-waste management, training citizens on e-waste management and make follow-up on e-waste management. All of these functions require financial resources and equipment for proper implementation. Therefore, this study will assess the role of resources in enhancing proper e-waste management, which obviously is assessing the application of resource dependence theory on e-waste management.

### 2.2.2 E-Waste Management In Developed Countries

Human beings have been exposed to the horrific effects of cross boundary movements of Hazardous wastes in developing countries. In the 1990s, governments in the European Union (EU), Japan, the United States (US) and some other industrialized countries began to tighten the regulatory framework against electronic wastes and simultaneously commenced the setting up of electronic waste retrieval and recycling systems. However, not all industrialized countries had the capacity to deal with the steep quantity of the electronic and electrical wastes they generated (Olowu, 2012).

Due to lack of facilities, high labour costs, and tough environmental regulations, rich countries tend not to recycle E-waste. Instead, it is either land filled, or exported from rich countries to poor countries, where it may be recycled using primitive techniques and little regard for worker safety of environmental protection (Cobbing, 2008). According to Kiddee et al (2013), there is currently extensive research into e-waste management in order to mitigate problems at both the national and

international levels in developed countries. Several tools have been developed and applied to e-waste management including: Life Cycle Assessment (LCA), Material Flow Analysis (MFA), Multi Criteria Analysis (MCA) and Extended Producer Responsibility (EPR).

Kiddee et al (2013) also stressed that the key to success in terms of e-waste management is to develop eco-design devices, properly collect e-waste, recover and recycle material by safe methods, dispose of e-waste by suitable techniques, forbid the transfer of used electronic devices to developing countries, and raise awareness of the impact of e-waste. No single tool is adequate but together they can complement each other to solve this issue.

Over the recent past, the global market of electrical and electronic equipment (EEE) has grown exponentially, while the lifespan of these products has become increasingly shorter. More of these products are ending up in rubbish dumps and recycling centres, posing a new challenge to policy makers. One more aggressive but challenging approach to minimizing illegal dumping of electronics is to impose tougher laws. Some States in the US govern e-Waste to ensure a much greater enforcement. Strictly enforcing these laws is strongly suggested as a way to prevent those who make a certain kind of “donations” to developing countries. Future efforts to minimize illegal dumping will undoubtedly include a combination of aggressive legislation, new technological solutions, and increased public awareness through more education on e-Waste. Present laws should be evaluated and modified periodically to allow proper progression. Educating people about how to recycle,

reuse, and dispose electronics at all levels will teach them and their communities how to behave more responsibly towards the environment. Indeed, electronic waste is a global problem requiring a global solution (Bhutta et al, 2011).

Sthiannopkao et al (2013) stated that discarded electronic goods contain a range of toxic materials requiring special handling. Developed countries have conventions, directives, and laws to regulate their disposal, most based on extended producer responsibility. Manufacturers take back items collected by retailers and local governments for safe destruction or recovery of materials. Compliance, however, is difficult to assure, and frequently runs against economic incentives. The expense of proper disposal leads to the shipment of large amounts of e-waste to China, India, Pakistan, Nigeria, and other developing countries. Shipment is often through middlemen, and under tariff classifications that make quantities difficult to assess. There, despite the intents of national regulations and hazardous waste laws, most e-waste is treated as general refuse, or crudely processed, often by burning or acid baths, with recovery of only a few materials of value. As dioxins, furans, and heavy metals are released, harm to the environment, workers, and area residents is inevitable. The faster growth of e-waste generated in the developing than in the developed world presages continued expansion of a pervasive and inexpensive informal processing sector, efficient in its own way, but inherently hazard-ridden.

According to El Haggar, et al (2007), factors hindering waste management are the increase of waste generation, increase of processing costs the decrease of landfill space. El Haggar (2007) suggested that in order to diverge and minimize waste the

three R’s are common terms in waste management, they stand for reduce, reuse and recycle’. The three R,s have become a centre tenet in sustainable waste management efforts.

### 2.2.3 E-Waste Management In Developing Countries And Tanzania

According to Nnoron (2007), the challenges facing the developing countries in e-waste management include: an absence of infrastructure for appropriate waste management, an absence of legislation dealing specifically with e-waste, an absence of any framework for end-of-life (EoL) product take-back or implementation of extended producer responsibility (EPR). Effective management of e-waste in the developing countries demands the implementation of EPR, the establishment of product reuse through remanufacturing and the introduction of efficient recycling facilities. The implementation of a global system for the standardization and certification /labeling of secondhand appliances intended for export to developing countries will be required to control the export of electronic recyclables (e-scarp) in the name of secondhand appliances.

Electronic waste or e-waste is one of the rapidly growing problems of the world. E-waste comprises of a multitude of components, some containing toxic substances that can have an adverse impact on human health and the environment if not handled properly. In India, e-waste management assumes greater significance not only due to the generation of its own e-waste but also because of the dumping of e-waste from developed countries. This is coupled with India's lack of appropriate infrastructure and procedures for its disposal and recycling.

Literatures shows that Environmental Policy (1997), the Sustainable Industrial Development Policy (SIDP), National ICT policy (2003) are the policies which provide the guidance towards e-waste management in Tanzania (Koloseni and Shimba, 2012). However, there is no specific policy which guides the e-waste management in Tanzania. National Environmental Policy (1997) seeks to provide the framework for making fundamental changes that are needed to bring environmental considerations into the mainstream of decision making in Tanzania. The policy emphasizes on minimizing the environmental pollution and degradation (NEMC, 1997).

Sustainable Industrial Development Policy (1996) promotes the environmentally friendly and ecologically sustainable industrial development. In addition, the Policy promotes environmental conservation and emphasizes on integrated preventive environmental strategy to industrial processes, products and services (URT, 1996). This also applies to e-waste management because the industries are the ones who produce e-waste. Also the police may apply to industry products that are imported from other countries.

The National Information and Communication Technology (ICT) (2003) monitors and responds to environmental disasters and to collect and disseminate information on environmental problems URT (2003). Dissemination of information also aimed at creating the awareness to citizens on the importance of e-waste disposal and management and hence it is assumed to reduce the problems associated with e-waste management.

Most of E-waste materials are not recycled, because E-waste items tend to go out with household waste and receive no special treatment, of that which is collected, some 80% is exported to poor countries (Schmidt, 2006). Electronic equipment that is no longer of use to the original purchaser may be reused, effectively extending its lifespan. Reuse is ultimately the source of some E-waste in many poor countries (Puckett et al., 2002) that accept donations of equipment considered obsolete in rich countries. Old yet functional electronic equipment is often shipped to developing countries by well-meaning donors in the West. Unscrupulous organizations in rich countries use donations of obsolete electronic equipment as a loop-hole in the Basel Convention to export both functioning and non-functioning electronic equipment. Ladou and Lovegrove (2008) and Streicher-porte, et al (2005) argued that most developing countries lack e-waste regulations.

Asiimwe (2013) argued that in Rwanda, Burundi , Tanzania, Uganda and Kenya lack concrete regulations for e-waste yet the number of ICT users is continuously growing where the growth is high in all countries except Burundi. In all countries, products consumed are brand new, refurbished or old. China is the leading exporter of cheap ICT products most especially mobile phones and their accessories to developing countries. These cheap products are of low quality thus their lifetime is short. All governments encourage use of brand new products. On the other hand people prefer cheap goods and thus old and refurbished products are also used. In countries such as Uganda and Rwanda where old products are restricted, old products are imported under the umbrella of NGOs or through black markets. In all countries, governments are aware of e-waste as a serious problem although the awareness in

Burundi is not high. Rwanda, Kenya, Tanzania and Uganda have already realized the need to positive strategy towards building robust infrastructure for handling e-waste. The considerable financial constraints of ICT users in developing regions, strategies such as total ban of old imports are not reasonable.

Besides affordability factors, Nnorom (2007) suggests that e-waste is internally generated or imported illegally as used goods in an attempt to bridge the so-called digital divide. Economically, urbanization and the growing demand for consumer goods in different regions of the world have increased the demand supply of electronic products. This will lead to increased volume of e –waste for example Robinson (2009) shows that computers, mobile telephones and television sets will contribute 9.8 million tons in e-waste stream by 2015. These figures indicate that there will be a rise of 4.2 million in e-waste stream from 2010 to 2015 resulting from only computers, mobile telephones and television sets. Schluep (2009) states that besides formulating regulations for hindering the problem; governments should make users (citizens) aware of how to safely dispose of waste. People in developing regions have perceived use value of old materials; old garbage especially electronics is not disposed off or a long time. For example in Burundi “most of the waste lies in homes not on streets”. There is also a need for waste disposal centres because keeping waste in homes is attributed to lack of waste disposal centres for certain waste. E-waste has many benefits despite its disadvantages. Through proper recycling there are opportunities such as employment and waste bi- products. E-waste can generate revenue for example “on average, informal e-scrap recyclers in Nairobi can earn US$ 3 a day, which is above the global poverty alleviation target of

US$ 1. Electronic waste and the minimal regulations involving recycling have developed into a global problem. Discarded and unwanted electronics are finding their way into landfills and exported to third-world countries which use primitive recycling methods that have an impact on the surroundings. These waste components are responsible for hazardous pollution of the environment and affect the health of the population. Suggestions are presented for reducing such waste (Randy, 2011).

According to Timlett & Williams (2008), educational and promotional tools such education, event promotion and training is essential for the successful implementation of a waste management plan. Raising awareness about different waste management programs can have positive effects, but there are several methods which can be used to change behaviour to improve participation or correct problems.

## 2.3 Empirical Literature Review

Gaidajis et al (2010) assessed the e-waste management in Europe and Japan by descriptive and qualitative analysis, The findings revealed that in Greece 90% of e-waste for the same period had been mixed with other urban solid waste or had been recycled with other materials (e.g. metal waste). In the European Union, e-waste has been targeted regarding the prevention of environmental pollution, for the exploitation of resources and the reduction of landfill use. The legislation developed by the European Parliament is based on prevention, recycling and re-use of e-waste, so that the amount of the waste electrical and electronic equipment available is reduced. In Switzerland, consumers return the e-waste in a more convenient way, either through specified collection points, of retail companies or transporting the waste straight to the recycling spots. The materials are transported from the

collection points to the disassembly facilities, in order to disassemble and disinfect e-waste, by removing the most toxic factors. In the Japanese e-waste management system the withdrawal is not free of charge, but consumers pay an amount of money when they return used electronic products to the traders. Since 1998, Japan has established a withdrawal system for four types of e-waste (air conditioners, televisions, refrigerators and washing machines).

E-waste basically includes disposed materials of refrigerators, calculators, alarm clocks, computers, printers, televisions, monitors, audio setups, electronic thermometers, laser printer, etc, most of which contain batteries and other components. They carry traces of heavy elements and toxic compounds that threaten human and animal health and various other parts of ecosystem. As per the estimation, over 75% of subjects interviewed in this study lack of knowledge in storage and disposal techniques of E-waste. The situation may be worse in some other parts of the world. Finally, the study proposes viable procedures for the safe management of E-waste in Malaysia (Askari et al, 2014).

The study through descriptive and qualitative analysis discusses the current e-waste management system in Bangalore and proposes a new system. This study revealed that most of the e-waste in Bangalore is dumped in landfills or is incinerated, releasing harmful toxins into air and soil. Concerted efforts by various players in electronic product value chain, academic community and the government are required to evolve and implement a broad electronic waste management system in Bangalore (Nagendra, and Shekar, 2009). Similarly

Askari et al (2014) assessed the E-Waste Management focusing towards an appropriate policy in Malaysia by using descriptive and qualitative analysis. The study revealed that the generation of E-waste has been estimated to be about 652909 tonnes in 2006 and was extrapolated to reach around 706 000 tonnes in 2011 and about 1.2 million tonnes in 2020.

Schluep et al (2009) found that barriers for e-waste management in Kenya, Uganda, Senegal and Peru, India and China South Africa, Morocco, Colombia, Mexico and Brazil are low skills, poor recycling technology policy and legislation; technology and skills and in adequate financing. This study used both descriptive and qualitative analysis.

Asiimwe (2013) by using descriptive and qualitative analysis investigated the conceived role of East African Community (EAC) governments i.e., Kenya, Uganda, Tanzania, Rwanda and Burundi in combating negative impact of e-waste and how their views and current actions compare to the current state of the art in e-waste management. The results show that EAC governments consider e-waste to be a serious emerging problem. Despite this awareness and attempts to mitigate the problem in some of the countries, there are currently no solid solutions. The study suggested that practical solutions should be applicable in resolving e-waste challenges in EAC.

Magashi and Schluep (2011) found that lack of specific policy on e-waste management, lack of disposal facilities for hazardous wastes, general lack of proper recycling activities for e-waste, weak enforcement of legislation, lack of public

awareness on e-waste and its potential risks to the environment and human health, lack of infrastructure for formal collection and recycling of e-waste and illegal dumping of e-waste such as burning and bury were the factors affecting e-waste management in Tanzania. Their study used exponential growth and descriptive analysis.

Through SWOT analysis Gumbo and Kalegele (2015) assessed the e-waste management about its awareness, strategies, facilities, sources and treatment in Tanzania. The study found that e-waste management in Tanzania there was a lack of the following, there was poor awareness for e-waste management mechanism, and there are weak legislation, regulations guiding the e-waste management.

Koloseni and Shimba (2012) focusing the role of regulations in promoting the ICT waste disposal challenges and remedies in Tanzania by using the descriptive and qualitative analysis. Their study disclosed that lack of ICT asset disposal policy, storage facilities for end of use electronic products, lack of trained personnel in e-waste management, proper re-cycling initiatives and partnership and lack of awareness and skills for understanding the end use of phones and computers and lack of enforcement of e- waste related legislation hinder the proper disposal of ICT equipment in Tanzania.

Kaseva and Mbuligwe (2005) assessed the status of solid waste collection and disposal in Dar-es-salaam Tanzania by using the descriptive analysis focusing on the strength of private sector effectiveness on waste collection and disposal. The study

found that 957 tons/day of waste is collected by the three city municipalities of Dar es Salaam while only of 5.5% of waste are recycled. Similarly, Mataheroe (2009) by using the qualitative analysis found that in Dar es Salaam Tanzania there was inadequate awareness on the environmental and health risks of current E-waste. This was confirmed by the poor disposal techniques of e-waste, indicating that there was no specific of legislation and policy guiding the e-waste management.

## 2.4 Research Gap

Studies have been done to assess the management of e-waste in Tanzania where challenges have been identified and recommendations have been given. Some of these studies are Kaseva and Mbuligwe (2005), Mataheroe (2009), Koloseni and Shimba (2012) Magashi and Schluep (2011). Some of these studies show that there is fast growing use of Information and Communication Technology (ICT) and rapid turn-over in technology which is creating a growing e-waste stream not only in industrialized but also in developing countries like Tanzania. The challenge of e-waste is even of greater concern in developing countries because most of these countries lack the capacity for handling and recycling the hazardous materials contained in e-waste. This leads to disposal of both e-waste and municipal waste in dumpsites hence polluting the environment and creating health risks to the nearby community and the population at large.

Analysis of the studies done indicate there still a gap because only few studies is done in Tanzania for example, Koloseni and Simba (2012) covered for urban centres of Der es –salaam in depth study, Arusha, Moshi and Zanzibar. However, Arusha

City hosts numerous small and large businesses, banking, retail and commercial enterprises making the largest city in the Northern Tanzania. This can also lead to an increase of the number of ICT users, implying that as the number of ICT users grows, e-wastes also increases which endangers both environment and human health. Hence more study of e-waste management is needed to be conducted in this city. Moreover, this year 2016 four years has elapsed since this study was conducted. Therefore, we believe that there is influx of more e-waste than in 2012, when Koloseni and Simba did their study. This study also includes the assessment on the level of awareness of e-waste to the surrounding Arusha communities which was not covered by Koloseni and Simba (2012). This study also assessed the present methods which are used to dispose electronic waste and the better way of handling e- waste was suggested.

This is why the researcher considers that it was necessary to assess electronics waste management in Arusha Municipality. Therefore, the study assessed the level of electronic wastes accumulation in study area, common types of electronic wastes, quantity of the electronic wastes, ways presently used to dispose the electronic wastes, community awareness on the effect of e- waste and suggest the better way of disposing it in order to safeguard the health of human being, animals and environmental at Arusha City and all over the country.

## 2.5 The Conceptual Framework

Status of electronic waste products accumulation, types of electronic waste products and ways presently used to dispose the hazardous electronic will be the motive for

the effective e-waste management depends on effective regulations and policies which impose the stringent regulations and policies which motivates people to implement the e-waste management. However, these require proper e-waste technologies on recycling which will convert e-waste into remarkable uses. All of these will be achieved if there are enough funds for recycling and formulating the policies and regulation and making supervision of regulations. Moreover, effective e-waste management needs expertise who are trained on e-waste who will train the society on effective e-waste management. Thus it is from this relationship that the nation will be able to manage the e waste such as phone wastage, computers wastage, refrigerators remains, radio remains and attain the best practice in terms of conserving the soil and creating health environments to human beings and animals that can be free from disease which increase the health budget and reduce the working force of the nation. The relationship between independent and dependent variables and its outputs is presented in Figure 1.-

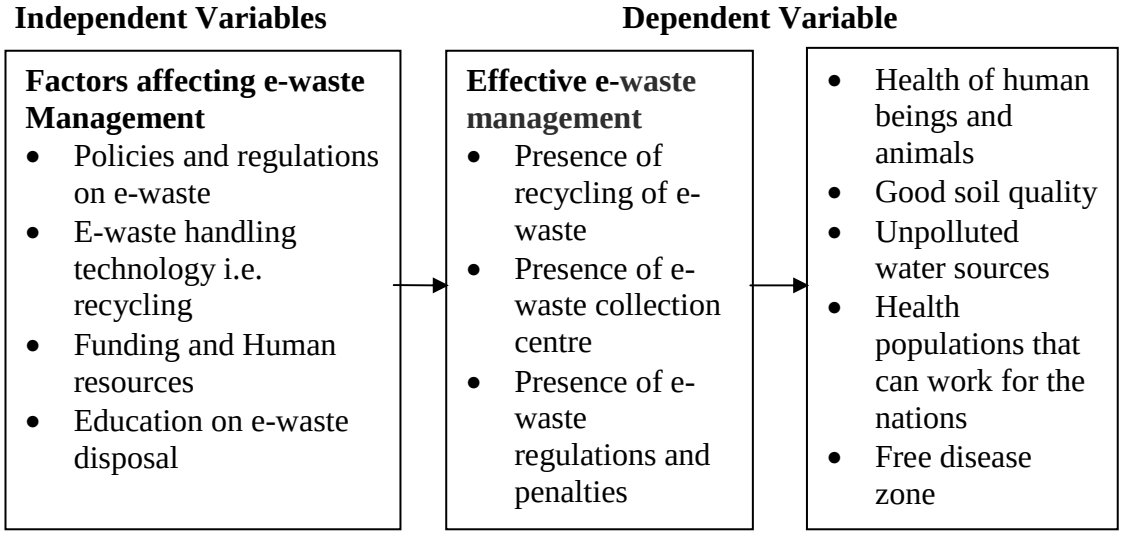


**Figure 2.1: The Conceptual Framework**

Source: Modified from Empirical Literature Review

# CHAPTER THREE

# 3.0 RESEARCH METHODOLOGY

## 3.1 Overview

This chapter presents methodological issue on which the analytical part of this study is based. The chapter starts with an overview of study site in section one. This is followed by research design to be used.The section describes the procedures used to collect data for study, data processing and analysis.

## 3.2 Study Area

The study area is Arusha City. Arusha City is one of the six districts of Arusha region. It is the head quarter of Arusha region located in Northern Tanzania between Latitude 20 and 60 South and Longitudes 34.50 and 38.00 East. It has unique characteristics of being surrounded by Arumeru District in all directions. The City is 50 kilometers West of Kilimanjaro International Airport on the great North Road and 6 kms from Arusha Airport. The City is well linked to other areas of Tanzania by air and roads. The total length of the road network within the City is 334.7 km out of which 196km are earth roads, 54km are gravel and 84.7 are paved roads. The City is also linked with two National main routes that go to Nairobi via Namanga and Dodoma. View for Arusha City headquarters and clock tower “a symbol where it marks half way of the Great North road between Johannesburg and Cairo. According to the 2012 census, the Arusha City population is 416,442 where by males are 199,524 and females are 216,918. Population density is 2002 per square kilometer. The primary industry of the City is the service sector.

The City hosts numerous small and large businesses, banking, retail and commercial enterprises thus making it the financial and cultural capital of the Arusha region. The largest manufacturing sector in the City is breweries, textiles/garments, agro-forestry processing, food staffs and other goods Tourism is also a major contributor to the economy of the City of Arusha, given the City's location near some of the greatest National Parks and Game Reserves in Africa. It has become major destination in East Africa for tourists from all over the world. As a result of that the City is playing host to several tour companies, lodges and hotels. Economic activities in the City are well diversified, from tourism, food processing and manufacturing of goods. The City is also a centre for major government offices and other non-governmental organizations in the Northern Tanzania (www.arushacc.go.tz , 2015). Arusha city was selected as an area of the study because is the second largest city in Tanzania after Dar es Salaam. Therefore it has e-waste generation potentials.

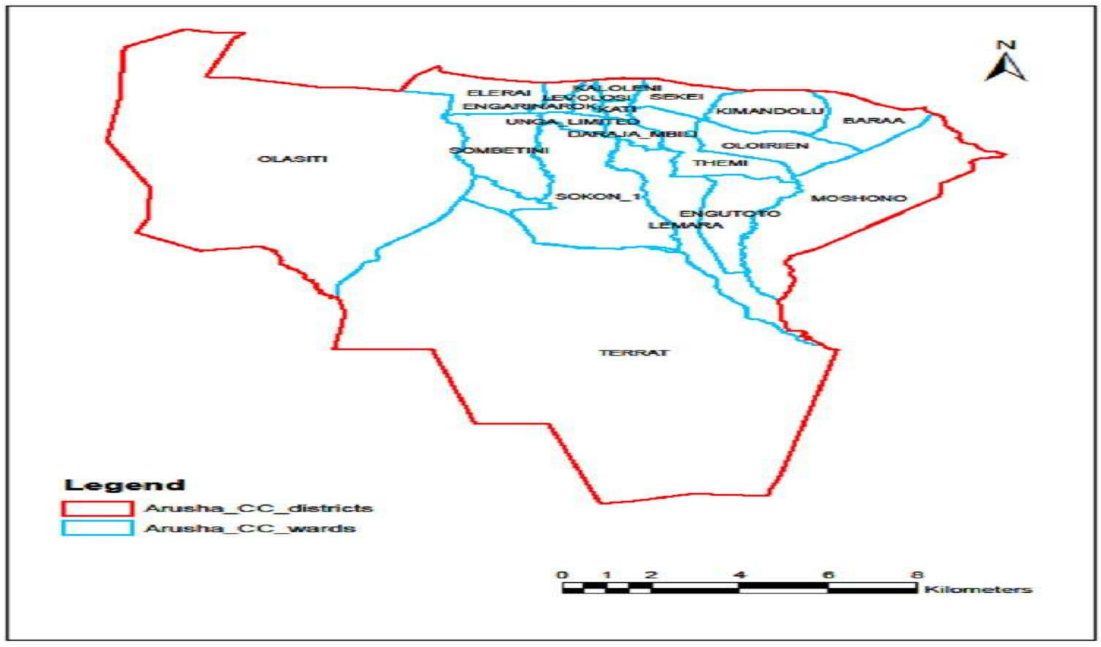


**Figure 3.1: Location of Arusha City Council**

Source: www.arushacc.go.tz (2016)

## 3.3 Research Design

The cross-sectional research design was used in the study. This design as opposed to longitudinal research design allowed data and information to be collected at one point in time and established a relationship between variables and parameters for the purpose of testing the hypotheses (Kothari, 2004). This method or design is considered to be useful because of time limit, human physical, material and financial resources availability, easy and to manipulate data using descriptive statistics.

## 3.4 Sampling Procedures and the Sample Size

Sampling is a plan for obtaining a sample from a given population while sampling procedure refers to the technique or the procedure that researcher would adopt in selecting items for the sample (Kothari, 2004). A purposive sampling technique or procedure was applied to select a respondent for interviewing in the Arusha City. A sample size of 120 respondents was picked randomly using the city health and environment department records and from the electronic technicians while the random sampling was used to select the citizens to solicit their views about e-waste management.

## 3.5 Data Instruments and Data Collection

### 3.5.1 Primary Data Collection

Primary data was collected though administering the questionnaire. The questionnaires were prepared to both the company/instructions, to individuals, and to telephone artisans. The questionnaire comprised of both open and closed questions, which allowed the respondents to respond on issue of e waste in Arusha region. This

has comparative advantage of capturing customs, norms, beliefs, aspirations and feeling of the respondents unbiased (Kothari, 2004). Silverman (1997) further holds that the questionnaire has the advantage of covering the large area over a short time and it has low cost in terms of administering. The administrations of the questionnaire were done by taking the questionnaire to the respondents and ask them to fill the questionnaire after asking them some itemized questions. This reduced the problem of low response rate as it is associated with questionnaire.

### 3.5.2 Secondary Data Collection

This was achieved by using data drawn from literature search, published government reports and statistics to complement the primary data.

## 3.6 Data Processing and Analysis

Both qualitative and quantitative data was used for this study. The questionnaire was edited, coded, summarized and entered in the computer. Data analysis was done by special computer package called SPSS version 22 to derive descriptive statistics namely means, frequencies, percentages, graphs and tabulations.

## 3.7 Variables and Measurement Procedures

Variables to be measured are quality of policies and regulations, e-waste technology i.e recycling, funding availability, the roles of expertise and awareness education on enhancing the e-waste management, status of electronic waste products accumulation, types of hazardous electronic waste products and ways presently used to dispose the hazardous electronic waste products. The variables was analyzed by

descriptive analysis by using frequency, mean variances, standard deviation, minimum and maximum, and tables, cross tabulation pie chart and bar chart. Qualitative analysis also was used to analyze some of the variables.

## 3.8 Data Validity and Reliability

### 3.8.1 Data Validity

Kothari (2004) asserts that Validity indicates the degree to which an instrument measures what it is supposed to measure; that is the extent to which differences found with a measuring instrument reflect true difference among those being tested. For enhancing the data validity, questionnaire created from literature review and the questionnaires was administered to some selected people where by the ambiguous questions was avoided, triangulation methods in data collection was used, pre-testing of the questionnaire was done and experts in e-waste or environmental management was used to check the correctness of the research instrument.

### 3.8.2 Data Reliability

According to Kothari (2004), a reliable instrument is the one which provides consistent results when the research is repeated in the same place or different researchers. Data reliability estimates the degree to which a measurement is free of random or unstable error. In this study, the reliability of data was measured by using the Cronbach alpha which ranges from 0 to 1. According to Kothari (2004), a score from 0.7 implies that data is reasonably reliable.

### 3.9 Ethics

The research ethics is very important for any research. However, through the researcher is in the struggle to access the data this should not violate the right of the respondents. The current researcher followed all ethics in research by obtaining the permission from the the Open University of Tanzania to allow her to conduct research on the e- waste management problem in Arusha. The current researcher also maintained the confidentiality of the research by protecting the names of the company and the individuals who volunteered during data collection. Lastly the researcher asked the respondents to participate willingly and no member was forced to participate in the study.

# CHAPTER FOUR

# 4.0 RESULTS AND DISCUSSION

## 4.1 Overview

This chapter covers the results and discussion where the findings from the study regarding e-waste management are presented and discussed. This study interviewed 40 individuals, 40 artisans and 40 companies and institutions found in Arusha City making the total respondents to be 120. The three categories of respondents were involved so as to have a picture of e-waste management at the Arusha city. The survey was done in November and December 2016. The responses of respondents are summarized in the discussion below.

## 4.2 Institutions Analysis

Currently many government institutions have many computer related electronic materials such as CRT, Mouse and keyboards. One government institutions was having 77 unused computer and other electronic equipment's. Among the 30 institutions under the survey, it was found that each institution at least it had used computers and other related ICT materials. Almost all institutions confessed to have e waste in their premises including CRT, Mouse and keyboards, mobile phones and air conditions. The management asserted that they support e-waste disposal merely by identifying e-waste equipment's and ask the permission of replacing them with new ones from the regional stock verifiers. All institutions asserted that they are aware on the presence of guidelines about e-waste management. The study reveals that none of the institutions practiced e-waste technology. Also the study reveals that

no funds were located for e-waste activities. It was noted also that there was no experts/section/department dealing with e-waste management. Some of the institution had not much e waste and the little amounts they have were stored in their premises. However, the zonal management representative of one institution asserted that they are aware on the profit gained from the e-waste recycling. Also he asserted that he know that there is no specific guidelines for e-waste management but there are regulations and guidelines for disposing hazardous waste. Moreover, he asserted that no specific policy is known for e-waste management but there are other relevance policies like environment policy (1997) which emphasizes the protection and conservation of environment, ICT policy (2003) which encourages the effective utilization of ICT on improving the livelihood of the citizens. The environmental policy also emphasizes on minimizing the environmental degradation and pollution.

The study reveals that some institutions have taken initiatives to deals with e-waste. For example one institution invited evaluators for e-waste evaluation but no feedback was given on when the evaluation about e-waste will be done. Some institutions stated that there should be a mandatory e-waste disposal for every institution and the authority responsible for e-waste should make follow up. They asserted that this will be possible if a time frame should be allocated for electronic materials waste disposal and penalty should be charged for an individual or company who will use the electronic equipment contrary to the time frame allocated for that particular electronic material. One institution stated that in their institution electronic equipment's are used only for four years then are given to the community and be replaced by new ones. One representative of government institutions asserted that e-waste are only poorly stored, condemned and publically sold under open air

tender/auctioning. When asked what should be done? He asserted that, “I suggest that the issue of e-waste disposal should be centrally handled as if poorly managed will have a high and dangerous impact on environmental pollution impact so some of e-waste materials are hazardous to human life even other living organism which are responsible for ecological management cycle”. A representative of one computer centre in Arusha municipality asserted that there should be an area or electronic waste disposal station. This computer centre has started in 1985 and he has 79 employees, has more than 100 desk top computers, 90 lap top computers 14, printers, 3 TVs, 2 fridges and 5 air conditions. This indicates that in the coming years, this institution will generate substantial amounts of e-waste. The representative of the management said that “We need more knowledge about e-waste management in our organizations”. This signifies that knowledge about the e-waste disposal is not mainstreamed yet.

**Figure 4.1: A Researcher Receiving Some Explanation From IT Staff At A Certain Institute**

Source: A Researcher

### 4.3 Individuals Possession of Electronic Materials

The findings from the field show that the number of ICT equipment owned by individual persons were desk top and laptop computers, printers, mobile phones and TVs and ranged from 1 to 15.However, individuals owned other electronic equipment which they bring to electronic repair artisan when their electronic equipment get defects. The data signifies that individual person does not own large number of equipment which can generate large quantities of e-waste. However, this should not be taken for granted because the numbers of e-equipment accumulate year after year. The individuals also asserted that they usually store the e-waste materials at home or left them at the artisans.

Individuals asserted that electronic tools that are considered as e-waste are abandoned by owners to the electronic repair artisan. They recommended that e-waste should be collected and returned to the manufactures. They proposed that education on handling-e-waste should be provided and disposal should be done separately not with other wastes. Some individuals asserted that the e-waste materials should be collect by city council and handle them. They proposed that municipal council may collected and burn them at the damp site. Some individuals asserted that they sell the e-wastes such as phone to the electronic repair artisan at a price between Tshs 5,000-10,000. They also asserted that other electronic e-waste materials that are handled to electronic artisan for repair are, iron, radio, extension cable, charger, tube lights, bulbs, cooker, micro oven food, mixer, fridge, solar panel, wash machine and water dispense. Individuals asserted when there would be special regulations for disposing e-waste, purchasing of e-waste should be done by the licensed persons so

as to avoid theft. Also they recommended that e-wastes should be collected and sorted from home and be prepared ready for damping or recycling.

### 4.4 Electronic Tools Artisans' Response

The data also shows that the electronic repair artisan follows in terms of electronic equipment possession where they possess up to 100 mobile phones each. The electronic equipment artisan stated that they repairs laptop computers, photocopy machines, electronic kettle, mobile phones, radio, TVs, DVDs Deck recorder, fridge, gas cooker, air condition, wash machine, micro wave, blender, electronic jag, iron and other related electronic materials. When asked what they think to be done in order to have effective e-waste management, they asserted that guidance on e-waste management should be provided. Others asserted that the counterfeit electronic equipment which are likely to become e-wastes should be returned to the manufacturers. Some asserted that importers of counterfeit electronic materials should be responsible for e-waste management and also the education on how to dispose without polluting the environment should be provided. They also recommended on the establishment of factories for e-waste recycling.

Artisans reported to have 20 up to 100 items of electronic equipment which they repair. However, the findings show that electronic repair artisans were having some ICT materials which were not in use. The data shows that only the mean age of the telephone artisan was 44 years signifying that people of different categories participate in the a telephone artisan activity.

The field data shows that the artisans were repairing mostly the desktop computers, television and TV. The artisans proposed that e-waste can be managed well if there is effective e-waste policy. Also the e-waste disposal should be done according to the time frame proposed by the manufacturers of electronic equipment. Also the special training for technicians on how to dispose e-waste should be provided where the experts should be engaged during the disposal of e-waste. They said that this will be possible if there will be a training Centre for this purpose. Moreover, the artisans recommended using the effective e-waste disposal technology. However, some of them asserted that e-waste can be sold as spare and used for the other ICT equipment which need spares. The artisans also proposed that the city should collect e-waste and e-waste should be used as spare parts and they insisted on the purchasing of original electronic equipment and the municipal should impose laws and regulations on proper disposal of the e-waste.

**Figure 2.2: E- Waste as Found at Artisan Premise Near "Mnara wa Mwenge" Arusha**

Source: Researcher

### 4.5 Does The Premise Happen to Remain With E Waste?

When the respondents were asked whether their premises happen to remain with e-waste; Table 4.1 summarizes that 93%, 98 % and 85% of individuals, artisans and company or institutions affirmed that their premises have e-waste. This signifies that there is no policy or procedure which guides the e-waste disposal. It means that if there is a procedure which guides e-waste disposal, individual, company/institutions or artisans would not remain with e-waste in their premises. The remaining individual, institutions or company asserted that they usually sell the used electronic materials or distribute to the society as their part of the corporate social responsibility. Some institutions also asserted that they return the used electronic materials to their headquarters which has mandate to decide on the ultimate of these electronic materials.

**Table 4.1: Premise Happen to Remain With E-Waste**

| Category | Yes-Percentages | No-Percentages |
|---|---|---|
| Individual | 93 | 7 |
| Artisans | 98 | 2 |
| Company/Institutions | 85 | 15 |

### 4.6 Do You Have Any Guideline For Disposing E- Waste?

When respondents were asked if they know the guidelines regarding the disposal of e-waste, the responses are presented in Table 4.2. The findings from the study indicate that only the institutions know on the presence of guidelines on e-waste. However, the findings show that only 10% and 5% of the individuals and artisans respectively know on the presence of guidelines about the e-waste disposal. The results indicate that only very few individuals and artisans know about e-waste

disposal. This calls for the policy makers to enforce or designing the new policy concerning with e-waste management. The respondents asserted that the guidelines may be formulated from the act, local government or the existing policies.

### 4.7 Proposal on Handling of E-Waste Found in Premises

The results in Table 4.2 provide the proposal on how to handle e-waste from the respondents. The results show that majority of respondents from the individuals, artisans and institutions recommended that there should be a centre for e-waste collection and recycling. The results also show that others recommended that e-waste should be sold where the owners of e-waste will earn some income. The results indicate that e-waste can be a source of income generation for entrepreneurs because individuals and company can establish business concerned e-waste recycling. During the survey many respondents stated that e-waste can be a source of income generation for entrepreneurs if they will be facilitated by the government.

**Table 4.2: Proposal On Handling Of E-Waste Found In Premises**

| Proposed Ways | Frequency | Percent |
|---|---|---|
| Collection centre and recycling | 60 | 50.0 |
| Returned to manufacturer | 20 | 17 |
| Selling | 40 | 33 |
| Total | 120 | 100.0 |

### 4.8 Right Way of E-Waste Disposal

When respondents were asked whether they know on the right way of disposing e-waste; the individuals and artisans asserted to have low knowledge on e-waste disposal relative to companies or institutions as indicated in Table 4.3. Despite the

companies and institutions had relative high awareness on e-waste disposal, the study finds that none of the company, institution or individual was disposing e-waste instead they stored the e-wastes in their premises. This certifies that there is no good arrangement on e-waste disposal hence the authorities concerned with the policy should enforce the policies and create awareness on e-waste disposal to citizens. Majority of the respondents (90%) asserted that it is essential to have guidelines related with e-waste disposal since e-wastes cause environmental hazards.

**Table 4.3: Right Way of Disposing E Waste**

| Category | Yes-Percentages | No-Percentages |
|---|---|---|
| Individual | 2.5 | 97.5 |
| Artisans | 7.5 | 92.5 |
| Company/Institutions | 30% | 70% |

### 4.9 Discussion of the Findings Based on Specific Objectives

This study was done to assess the following objectives:

i) To assess the influence of policies and regulations on e-waste management

ii) To assess the influence of e-waste handling technology on e-waste management

iii) To assesses the influence of human and financial resources on e-waste management

iv) To assess the role of e-waste disposal education of e- waste management

The following sections present the discussions based on the specific of the study. The sections present the implication of the findings on each objective and we compare and contrast our finding with previous studies to make our findings more meaningful.

### 4.9.1 The Influence of Policies and Regulations on E-Waste Management

The study finds that there is no specific policy or regulations specifically for e-waste. The used policies are environment policy (1997) which emphasizes the protection and conservation of environment, ICT policy (2003) which encourages the effective utilization of ICT on improving the livelihood of the citizens. However, these policies does not specify on how to manage e-waste. The issues of e-waste is very serious, therefore a new policy for e-waste should formulated and approved by relevant authorities for the effective management of e-waste. Since the policy will lead to effective management of e-waste, formulation of guidelines for storage and damping of e-waste it will help the management of the city councils to design proper ways of handling of e-waste. The policy also will help the enforcement of law regarding e-waste management where in the law the penalties against the improper handling of e-waste will be specified. The penalties should be stringent so as to avoid the improper e-waste disposal. We believe that setting of severe fines and penalties for improper waste disposal will discourage individuals, companies and institution to dispose e-waste the way they like.

The policy also will specify the role of government, institutions and individuals in e-waste management. For example it will specify on how to make follow-up on counterfeit products and it will specify on what to do on e-waste products. The current situation what the government is doing is to destroy the counterfeit products but this process it is not recommended for e-waste because the e-waste products can generate more hazards to environment if burned and hence they can’t be destroyed like normal goods such as food, home utensils or other products. Storage of e-

product in homes also is harmful because e-waste becomes more harmful as they are continually be stored without treating them. Therefore, the laws and regulations will guide the user of electronic products on the best way to store the electronic product and on what to do if the electronic equipment reaches its proposed end life spans. The guidelines also will specify on the roles of the importers regarding the e-waste management.

Various scholars have recommended the importance of having effective and enforceable policy, laws and regulations concerning e-waste management. Gumbo and Kalegele (2015) indicated that 97.1% of the institutions in Arusha municipality don't have a policy to better handle e-waste in their organizations. Magashi and Schluep (2011) assert that despite there is Environmental Management Act (2004) which incorporated the regulations on hazardous waste in enforced. It is obvious that having regulations without implementation and enforcement does not bring changes in e-waste management practice.

The results of this study is also in tandem with Koloseni and Shimba (2012) who asserted that The Tanzania has no specific policy or regulation related to e-waste management. The study asserted that Environmental Policy (2003), the Sustainable Industrial Policy (1999), National ICT Policy (2003) are not sufficient to manage the e-waste in Tanzania since each policy concentrates only on its specifications. Also these policies have been formulated many years back and it is possible that they lack some contents that are related with e-waste management. Moreover, the study of Koloseni and Shimba (2012) has been conducted in five years back which can't give

the full pictures of the current e-waste accumulation. Therefore, based on the finding of this study, the establishment of new e-waste regulation, policy and guidelines are vital since there is relative increase of accumulation of e-waste compared to 2012.

Maschio et al (2013) asserted that Waste Electrical and Electronic Equipment containing Cathode Ray Tube (CRT) materials require effective regulations to enhance their e-waste management in Italy. The study asserted that if possible these regulations should be very strict as those practiced in developed countries such as USA and Europe.

Ylä-Mella et al (2014) asserts that Finland government amended the waste act to incorporate issues related with e-waste which come into force since 1st May in 2013. This signifies that despite the electronic waste management exists in the environmental management act (2004), there is a need to amend the existing law of waste management by designing the strategies which will enforce the regulations concerning electronic waste management. Suja et al (2014) reports that in Malaysia regulations for managing e-waste have been formulated and they act as vital for e-waste management in the country. Implying that if we will enforce the regulations concerning e-waste management will succeed to manage the e-waste management in Tanzania.

### 4.9.2 The Influence of E-Waste Handling Technology on E-Waste Management

During the survey, all respondents asserted that the e-waste processing/recycling technology is essential for the management of e-waste. It implies that, e-waste

recycling technology it will be helpful in management of e-waste because it is a demand driven. However, the study reveals that there is no factory which process e-waste in Tanzania. Some respondents asserted they sell e-waste at low costs so that are used as electronic equipment' spares. Presence of e-waste technology may help different categories of stakeholders. Indeed, some respondents said that e-waste technology is an opportunity which has not being utilized. Hence investors may be benefited by investing in e-waste technology and since the government will be interested their investments and may subsidize their investment. Also the youths and poor men and women would use the collection of e-waste as their income generating opportunity. In Tanzania there is a recycling of plastic equipment. Hence the author believes that it is possible also for them to invest also in e-waste recycling.

During the survey, it was revealed that both individual, companies and institutions stores the electronic equipment at home and some of institutions and electronic equipment artisans were having reasonable quantities of electronic equipment which have become e-waste. Hence justification for establishment of recycling industries is solid. The government of Tanzania is insisting on the industrialized Tanzania. Therefore, the government when thinks to establish other industries; we think it is better also having plan on establishment of electronic waste industries because this will not only create jobs among Tanzanians but also will reduce the hazardous effects associated with e-waste on both human beings and environment.

Many scholars have discussed the importance of recycling technology on e-waste management. The results from this study are related with Maschio et al (2013) who

asserted that recycling of e-waste materials should subsidized by the government of Finland so as to reduce the cost and maximize the products reuse. This also will encourage the e-waste investor to invest more in recycling technologies. Maschio et al (2013) also asserted that in Finland, associations of electrical and electronic equipment producers and importers formed five associations for organizing the collection and recycling of electrical and electronic equipment. This is important because if producers and importers of e-waste have associations, it makes the task of e-waste collection and recycling easy. Suja et al (2014) reported that Malaysia government has set strategies to collect information regarding generation of e-waste in the country. It also permits only licensed facilities to recover and treat the e-waste. However, the author insisted that regular follow-up is made to ensure that only permitted industries perform the waste recycling activities as directed by the government of Malyasia.

Wong et al (2007) asserted that because of lack of capacity in handling and recycling the hazardous contained e-waste materials; e-waste materials are damped together with other wastes which are dangerous to people because not only e-waste pollutes the environment but also they contain heavy metals such as Cd, Pb, Hg, and chemicals like polychlorinated dibenzo-p-dioxins (PCDDs) and others. Ibrahim et al (2013) also asserts that lacks of e waste processing technology is a problem also in Nigeria. They proposed to have the collection centre and recycling technology in order to tackle the problem. This signifies that many African countries require the e-waste recycling technologies in order to minimize the effects of e-waste. Koloseni and Shimba (2012) asserted that Tanzania has no industries to recycle e- wastes. It

means that all wastes are collected and disposed together with other solid waste which is dangerous to the health of human being and other living organisms.

### 4.9.3 The Influence of Human and Financial Resources on E-Waste Management

The study reveals that there is no section or department dealing with e-waste management both in government and government institutions. This implies that implementation of e-waste management will not succeed well because there are neither strategies for e-waste management hence no follow-up on issues related with e-waste management in these organizations. It true that the management of environment and other sectors are implemented well because there are staff who implement the government orders, duties and tasks. Therefore, the government and private institutions should establish the sections which their staff will implementations of strategies related with e-waste management. Also the learning institutions such as universities and colleges should have programmes related with e-waste management. These programmes will prepare the experts who will be responsible for e-waste management sustainably.

Also when individual, artisans, companies and institutions when asked whether they have allocated for funds e-waste management, none of them responded about allocation of funds for e-waste management. This asserts that the individuals, artisans, companies and institutions have allocated less weight on e-waste management. Indeed, financial resources are very vital in enhancing e-waste management. Normally in making normal waste management process successfully;

individuals, companies and institutions contributes to e-waste management, implying that they can also contribute to e-waste management activities such as collecting, recycling or investing in e-waste management. The government can also charge the e-waste disposal fees say annually and this may facilitate the e-waste management in organization working places.

Since every house or institution accumulates e-waste, the government can arrange that every house to contribute for e-waste recycling and this will facilitate the reduction of e-waste in individual homes and institution places. The importers of electronic equipment which accumulate e-waste also may be charged some amount of fee which will be used to process the e-waste. Moreover, e-waste funding agency may be established so as to have sustainable e-waste recycling. If these strategies are adopted, the processing of e-waste will be sustainable and impacts of hazardous e-waste will be minimized.

Some scholars also have discussed the role of human and financial resources on e-waste management. Magashi and Schluep (2011) assert that financial constraints hamper the implementation of Environmental Management Act (2004) in Tanzania. The study stressed that in order to manage e-waste effectively and efficiently in Tanzania, there is a need to address the challenges of technical, financial and human resource constraints. Mataheroe (2009) asserted that financial resources help in an E-waste management system in terms of incurring costs of collection and recycling in Tanzania. The study stressed that it is important for all stakeholders to participate in e-waste collection and recycling in Tanzania. These stakeholders include electronic

equipment dealers, municipal councils and government bodies. The study added that other method includes encouraging the manufacture of electronic equipment to participate in e-waste recycling and soliciting finances from outside Tanzania which have interests with e-waste management.

Suja et al (2014) asserted that Malaysian government has designed various ways to finance the e-waste management including charging the license fees from the producers of electronic equipment. Ylä-Mella et al (2014) argued that effective management of e-waste has relationship with financial resources because the financial resources enables the proper collection, treatment and recovery/recycling of e-waste in Finland.

Fei-Baffoe et al (2014) asserted that in Ghana delay in payment for private waste collectors is a challenge towards effective waste management in Ghana. This challenge limits the collectors to undertake adequate waste collection in Ghana and hence led the accumulation of waste. This signifies that effective coordination of stakeholders involves in e-waste is a key for effective e-waste collections. Lino and Ismail (2013) asserted that in Brazil a reasonable amount of fund is earned due selling of e-waste. However, the price of e-waste varied due changes of supply and demand forces in the market. Moreover, e-waste managed to employ about 7700 waste collectors where they receive a salary of R$ 622 per month or and the job managed to create 24,169 additional family Grants worth R$ 200/month. This also can be done in Tanzania where citizens will be employed in e-waste management sector.

### 4.9.4 The Role of E-Waste Disposal Education of E- Waste Management

E-waste education plays significance role in enhancing the e-waste management because if stakeholders are educated about e-waste, they may play the significance roles in e-waste management. The study reveals that at least stakeholders understand the effects of hazardous e-waste. But no deep education has been provided on how to handle the e-waste for individuals, electronic repair artisans, companies and for government and private institutions. Therefore, it is important for stakeholders in e-waste management to be trained on how to handle e-waste management. Imparting skills and knowledge on e-waste for stakeholders can be done through having a specialized programme of education where all stakeholders will participants in the training.

Training also is associated with training budget. Hence the organizations responsible for e-waste management, needs to set budget for e-waste management. Also for sustainable e-waste management, experts responsible for e-waste management should be developed. Therefore, a strategic training needs assessments and training plans need to be developed by all stakeholders who will be involved in training. Hence training and awareness creation should be given higher priority by all stakeholders responsible for e-waste management. Also the training and awareness creation in e-waste management should begin from primary education to university level to enable all citizens to understand the effects of e-waste management. The empirical literatures describe the importance of education, training and e-waste awareness creation on e-waste management in various countries in the world.

Ylä-Mella (2014) asserted that the Swedish and Norwegian governments have experienced that creating awareness in electronic waste management is vital towards management of e-waste. Hence awareness creation has led to increasing to more environmentally sound behaviour among the citizens in Sweden and Norway. The study recommended that electronic equipment companies may participate in awareness creation to their customers. For example Nokia Company has participated in the awareness creating for their customers for several years. Awareness creating is essential for improving the individual behaviour regarding e-waste management.

Koloseni and Shimba (2012) argued that training managers in electronic organizations raise the employees and the users of electronic equipment concerning e-waste management practices. The training contents in e-waste may include on how to dispose electronic infrastructures and equipment. The study argues that if workers in the electronics sector are not trained, it may discourage the electronic waste management. The study asserted that cooperation in raising awareness between companies manufacturing electronic products and other stakeholders is vital for effective e-waste management.

Mataheroe (2009) stated that in Tanzania awareness on the damage E-waste is lacking. This causes the illegal dumping of waste and there is possibility of e-waste to cause the environment and human health hazards. The study asserted that Local authorities, like the Dar es Salaam City Council, may participate in creating awareness on e-waste management. Suja et al (2014) declared that awareness on effective e-waste management should match with recruitment of the competency

staff who will train other people to enable them to understand the hazards or risks of e-waste and hence handle them appropriately. Awareness raising and capacity development of employees may be done through seminars or any other form of trainings. However, lack of the awareness in handling e-waste is a problem of many third world countries such as Thai-land.

Gumbo and Kalegele (2015) found that more than 50% of the respondents were not aware on the hazardous effect associated with e-waste. Also more than 97% of the respondents were not aware on the role of the government in managing e waste. Magashi and Schluep (2011) asserted that lack of public awareness on e-waste and its potential risks to the environment and human health towards e-waste management. The main problem is lack of awareness on the presence of precious metals in computers, TVs, mobile phones and other IT equipment. As a result, there is no structured education in Tanzania which is specifically explaining on to handle hazardous e-wastes. Issahaku et al (2014) stated that in Ghana 84% of the waste collectors received training on waste management and safety once every six months. However, the main focus of training is ordinary waste and not the electronic waste. This signifies that e-waste management education, training and awareness are still inadequate in developing countries.

### 4.9.5 Hypotheses testing

The study is guided by the following hypotheses:

i) Residents at Arusha city has high awareness on the hazards caused by electronic waste products in Arusha City. The study reveals that the

awareness on hazards caused by e-waste is low. Hence this hypothesis can't be accepted.

ii) Disposing of electronic waste products is done according to the existing regulations

The study reveals that disposing of electronic waste is not done according to the existing laws and regulations. i.e People were storing e-wastes at their home or office premises and disposal was done with other wastes. Hence this hypothesis can't be accepted.

# CHAPTER FIVE

# 5.0 CONCLUSION AND RECOMMENDATIONS

## 5.1 Overview

This chapter covers the summary of findings, conclusion, recommendations and directions for future research.

## 5.2 Summary of Findings

### 5.2.1 The Influence of Policies and Regulations on E-Waste Management

The study reveals that there is no specific regulation on e-waste management. The study further reveals that despite there is a modified section concerning e-waste management in environment act 2004, the enforcement of this act is still not yet. The study reveals that there was no guideline which guides the users of electronic tools on e-waste management.

### 5.2.2 The Influence of E-Waste Handling Technology on E-Waste Management

The study reveals that there is no e-waste handling technology in the study area. Instead the used electronic tools were sold as spare parts which were used to repair the defect electronic equipment. However, majority of respondents proposed the existence of recycling technology because not only will reduce the effects caused by hazardous waste but also will be used as income generating opportunity for various groups of people who will be involved in e-waste recycling as Brazilian experience showed.

### 5.2.3 The Influence of Human and Financial Resources on E-Waste Management

The study findings showed that there were no experts who were trained to handle the e-waste management in the country. Also the study notes that there was no individual, artisan or institution which had budget for e-waste management. Hence the study reveals that the influence of human and financial resource influences e-waste management is very high. The study further reveals that there is no strategic plan on how to use the human and material resources on the management of e-wastes.

### 5.2.4 The Role of E-Waste Disposal Education of E- Waste Management

The study reveals that education is important in facilitating the e-waste management. However, the study finds that the level of awareness creation on the effects of hazardous e-waste was very low across the community members because majority of surveyed participants did not know the effects of hazardous e-waste materials on the environment and on the human health.

## 5.3 Conclusion

The study reveals that poor enforcement of policy and regulations, lack of technology, absence of human and financial resources and lack of awareness on the importance of proper management of e-waste affects the management of e-waste in Arusha city.

## 5.4 Recommendations

Based on the findings of the study, this study recommends the following:

i) E-waste should be sorted to ensure that they are not mixed with other wastes. This will help in e-waste collecting and plans for recycling.

ii) Enforcement of e-waste policy and regulation. Tanzania government should guide citizens on dispose e-waste. Reasonable fines should be charged to an individual, company or institutions who will store e-waste at home or who will dispose e-waste illegally.

iii) Control quality of electronic products during importation-The government should ensure that the counterfeit products are not imported to Tanzania this will reduce the quantities of e-waste accumulation.

iv) Education should be given to the community on the effects of e-waste products. Majority of Tanzanians do not know the effects of e-waste. Hence training them is important so that they will be aware on the hazards caused by e-waste.

v) E-waste recycling industries should be established. Recycling of e-waste will not only reduce the e-waste accumulation in the country but also it will be a source of income generation for entrepreneurs who will participate in e-waste recycling.

vi) The individuals, artisans, private and government institutions should train staff who will be responsible in e-waste management. Also every stakeholder should set a budget which will be used to finance the e-waste management activities.

vii) Introduce curriculum in school to reflect the e-waste management in the community.

## 5.5 Direction of the Future Research

Since this research concentrated on one region, the study may be extended to all regions of Tanzania and this study will reveal the extent of the problem. Other studies may be conducted to assess why policies and regulations are not effective in enforcing the e-waste management. Moreover, the comparison study between e-waste and ordinary waste management may be conducted so as to explore the strategies and challenges facing the solid waste management and these strategies will be used as the lesson learnt to enhance the effective e-waste management. The study on how to utilize the e-waste products in industrialization should be considered.

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# APPENDICES

## APPENDIX 1: Questionnaire for Company/Institution

This questionnaire is designed to obtain information on presence of electronic wastes from dealers of electric and electrical wastes and how are they disposed. This information is for academic purpose in the fulfillment of special project, which is a requirement for achievement of Master degree award. It is semi-closed questionnaire, hand delivered and respondents can ask clarification where there is ambiguity or require clarification from the administrator of the questionnaire. The study will enable the researcher to advice the Government to determine the necessary step required for handling e- waste. I would be gratefully if you could spare some time to answer few questions.

**Part I**: Information about the Company/Institution

Name of Company/Institution: ……

Type of institution (Please tick applicable)

Company ☐ Government ☐ NGO ☐

Year of Establishment: ……

Principal Activity of the Company/Institution: ……..

Number of Employee……..

**1.** Does the premise ever happen to remain with Electronic wastes like Desk top computers (including CRT, mouse, keyboard) Laptop computers, Printers, Mobile phones, Televisions, Fridges, Air conditioners and Others.

Yes ☐ No ☐

2. Do records kept for any of these waste products? Yes ☐ No ☐

3. How many electronic equipment does your institution/company possess?

   Desk top computers (including CRT, mouse, keyboard) …….

   Laptop computers ……..

   Printers ……

   Mobile phones ……

   Televisions ……

   Fridges …….

   Others ……..

4. How many of them are not in use and still retained/stored by you?

   Desk top computers (including CRT, mouse, keyboard) …….

   Laptop computers ……..

   Printers ……

   Mobile phones ……

   Televisions ……

   Fridges …….

   Air conditioners ……

   Others ……

5. What are the commonly electronic wastes found in your premise?

   Mention……

   ……

6. What are the estimated quantities collected per year.

   Bulk (more than 19) ☐ Moderate (6-19) ☐ Minor (1-5) ☐

7. Does management support in dispose of e-waste?

   Yes ☐ No ☐

8. If Yes, explain briefly how

   ……

   ……

   ……

   ……

9. Do you have any guidelines in place that is followed to dispose the electronic wastes found in the institute? Yes ☐ No ☐

10. If Yes, where is the source of this guideline? Mention……..

    ……

    ……

    ……

    ……

11. Do you think that there are Effective policies and regulations on e-waste management?

    Yes ☐ No ☐

12. Have you ever practice e-waste technology i.e recycling?

    Yes ☐ No ☐

13. What is the amount of funds allocated for e-waste in your organization?

    ……..Tshs

14. Is this amount adequate? ☐ Yes ☐ No

15. Have you being trained on e waste handling management?

    Yes ☐ No ☐

16. Do you have experts/section/department dealing with e-waste management?

    a. Expert Yes ☐ No ☐

b. Section/department on e-waste management section/department

Yes ☐ No ☐

c. Does the Community is aware on the effect of e- waste

Yes ☐ No ☐

17. How do you handle electronic wastes in your premise? Mention commonly used method you're using for disposal. Burning ☐ Burial ☐ Collected by Municipality ☐ Returned to manufacturer ☐

18. Do you know any right way of disposing electronic wastes? Yes ☐ No ☐

19. Do you think there is any importance of having a disposal guideline for electronic waste disposal? ☐ Yes ☐ No

20. Are you aware about the environmental hazards caused by discarded electronic equipment? (e.g. computers, mobile phones, etc)

Yes ☐ No ☐

21. Are you aware that some electronic parts may be profitably recycled?

Yes ☐ No ☐

22. Are you aware that some fractions in e-waste need a special treatment in order to be safely disposed off?

Yes ☐ No ☐

23. Do you know any policy responsible for e-waste management?

Yes ☐ No ☐

24. If Yes what is the content of the policy in brief……

……

……

25. Mention strategies used to dispose e-waste for your company/institution

…….

…….

……

……

26. What would you suggest to be done with electronic waste management in your area?

Mention……

……

……

…….

**THANK YOU FOR YOUR RESPONSE**

**APPENDIX 2: Questionnaire for Respondents (Individuals)**

This questionnaire is designed to obtain information on presence of electronic wastes from dealers of electric and electrical wastes and how are they disposed. This information is for academic purpose in the fulfillment of special project, which is a requirement for achievement of Master degree award. It is semi-closed questionnaire, hand delivered and respondents can ask clarification where there is ambiguity or require clarification from the administrator of the questionnaire. The study will enable the researcher to advice the Government to determine the necessary step required for handling e- waste. I would be gratefully if you could spare some time to answer few questions.

**Part I**: Information about the respondent

1. Name of Respondent: ……
2. Age ……..
3. Genda Male ☐ Female ☐

**Part II**

1. How many electronic equipment does your premise possess?

   Desk top computers (including CRT, mouse, keyboard) …….

   Laptop computers ……..

   Printers ……

   Mobile phones ……

   Televisions ……

   Fridges …….

   Air conditioners ……

   Others ……..

2. How many of them are not in use? Desk top computers (including CRT, mouse, keyboard) …….

   Laptop computers ……..

   Printers ……

   Mobile phones ……

   Televisions ……

   Fridges …….

   Air conditioners ……

   Others ……

**3.** Does the premise ever happen to remain with Electronic wastes like Desk top computers(including CRT, mouse, keyboard) Laptop computers , Printers, Mobile phones, Televisions

   Fridges , Air conditioners and Others .Yes ☐ No ☐

4. What are the commonly electronic wastes found in your premise? Mention……..

5. What are the estimated quantities collected per year. Bulk☐ Moderat☐ Minor ☐

6. Do you have any guideline in place that is followed to dispose the electronic wastes found in the premises ☐ ☐o

7. If Yes where is the source of this guideline? Mention……..

8. How do you handle electronic wastes in your premise? Mention commonly used method you're using for disposal. Bu☐g B☐l Collected by ☐ Municipality ☐rned to manufacturer

9. Do you know any right way of disposing electronic wastes? Yes ☐ No ☐

10. Do you think there is any importance of having a disposal guideline for electronic waste disposal? Yes ☐ No ☐

11. What would you suggest to be done with electronic waste management in your area? Mention…….

12. Are you aware about the environmental hazards caused by discarded electronic equipment? (e.g. computers, mobile phones, etc) Yes ☐ No ☐

13. Are you aware that some electronic parts may be profitably recycled?

    Yes ☐ No ☐

14. Are you aware that some fractions in e-waste need a special treatment in order to be safely disposed of? Yes ☐ No ☐

**THANK YOU FOR YOUR RESPONSE**

**APPENDIX 3: Questionnaire for telephone artisan**

This questionnaire is designed to obtain information on presence of electronic wastes from dealers of electric and electrical wastes and how are they disposed. This information is for academic purpose in the fulfillment of special project, which is a requirement for achievement of Master degree award. It is semi-closed questionnaire, hand delivered and respondents can ask clarification where there is ambiguity or require clarification from the administrator of the questionnaire. The study will enable the researcher to advice the Government to determine the necessary step required for handling e- waste. I would be gratefully if you could spare some time to answer few questions.

**Part I**: Information about the premise

Name of premise: ……

Year of Establishment: ……

Principal Activity of the premise: ……..

Number of Employees: ……

1. How many electronic equipment does your premise possess?

   Desk top computers (including CRT, mouse, keyboard) …….

   Laptop computers ……..

   Printers ……

   Mobile phones ……

   Televisions ……

   Fridges …….

   Air conditioners ……

   Others ……..

2. How many of them are not in use?

   Desk top computers (including CRT, mouse, keyboard) …….

   Laptop computers ……..

   Printers ……

   Mobile phones ……

   Televisions ……

   Fridges …….

   Air conditioners ……

   Others ……

3. Does the premise ever happen to remain with Electronic wastes like Desk top computers (including CRT, mouse, keyboard), Laptop computers, Printers, Mobile phones, Televisions, Fridges, Air conditioners and Others

   Yes ☐ No ☐

4. What are the commonly electronic wastes found in your premise? Mention……..

5. What are the estimated quantities collected per year. Mention ……

6. Do you have any guideline in place that is followed to dispose the electronic wastes found in the premise? Yes ☐ No ☐

7. If Yes Where is the source of this guideline? Mention……..

8. How do you handle electronic wastes in your premise? Mention commonly used method you're using for disposal. Burning ☐ Burial ☐ Collected by Municipality ☐ Returned to manufacture ☐

9. Do you know any right way of disposing electronic wastes? Yes ☐ No ☐

10. .Do you think there is any importance of having a disposal guideline for electronic waste disposal? Yes ☐ No ☐

11. What would you suggest to be done with electronic waste management in your area? Mention…….

12. Are you aware about the environmental hazards caused by discarded electronic equipment? (e.g. computers, mobile phones, etc)

13. Are you aware that some electronic parts may be profitably recycled?

**14.** Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed of?

**THANK YOU FOR YOUR RESPONSE**

**APPENDIX 4: Research Budget**

The expected budget is presented in the Table below:

| Item | Particulars | Costs (Tsh) |
|---|---|---|
| **A** | Travel/transport costs (Lump sum) | **200,000/=** |
| **B** | **Per diems**<br>1. Researcher 20 days @ 120,000/= 2,400,000/=<br>2. 2 supervisors @ 300,000/=<br>3. Supporting staff; staff 2 X 10 days @ 60,000/= 1,200,000/=<br>4. Labour (lamp sum) 200,000 | **3,600,000/=** |
| **C** | **CONSUMABLE**<br>1. Stationary (Lump sum) 500,000/=<br>2. Typesetting print 200,000/-<br>3. Photocopying 150.000/=<br>4 Internet expenses 100,000/=<br>5 300,000/= | **950,000/=** |
| **E** | . Contingencies | **300,000/=** |
| **F** | **TOTAL** | **4,350,000/=** |

**APPENDIX 5: Time Bond**

| Item No. | Activity | Period |
|---|---|---|
| 1 | Proposal Development | January – April, 2016 |
| 2 | Presentation of the Proposal | May - 2016 |
| 3 | Correction | May - October 2016 |
| 4 | Data collection | November - December 2016 |
| 5 | Data analysis | January - February 2017 |
| 6 | Project writing | March - June 2017 |

## Appendix 6: Clearance Letter

**THE OPEN UNIVERSITY OF TANZANIA**

***DIRECTORATE OF RESEARCH, PUBLICATIONS, AND POSTGRADUATE STUDIES***

P.O. Box 23409 Fax: 255-22-2668759Dar es Salaam, Tanzania,
http://www.out.ac.tz

Tel: 255-22-2666752/2668445 ext.2101
Fax: 255-22-2668759,
E-mail: drpc@out.ac.tz

**16/11/2016**

Municipal Director
**Arusha**

**RE: RESEARCH CLEARANCE**

The Open University of Tanzania was established by an act of Parliament no. 17 of 1992. The act became operational on the 1st March 1993 by public notes No. 55 in the official Gazette. Act number 7 of 1992 has now been replaced by the Open University of Tanzania charter which is in line the university act of 2005. The charter became operational on 1st January 2007. One of the mission objectives of the university is to generate and apply knowledge through research. For this reason staff and students undertake research activities from time to time.

To facilitate the research function, the vice chancellor of the Open University of Tanzania was empowered to issue a research clearance to both staff and students of the university on behalf of the government of Tanzania and the Tanzania Commission of Science and Technology.

The purpose of this letter is to introduce to you **Ms KOKA Rehema Elias ; Reg No PG201400760** a Master student at the Open University of Tanzania. By this letter, **Ms KOKA Rehema Elias** has been granted clearance to conduct research in the country. The title of her research is **"An assessment of Electronic Waste Management in Arusha Municipality".**The research will beconducted at Arusha Municipality.

The period which this permission has been granted is from 16/11/ 2016 to 16/12/2016.

In case you need any further information, please contact:
The Deputy Vice Chancellor (Academic); The Open University of Tanzania; P.O. Box 23409; Dar Es Salaam. Tel: 022-2-2668820

We thank you in advance for your cooperation and facilitation of this research activity.
Yours sincerely,

**Prof Hossea Rwegoshora**

**For: VICE CHANCELLOR**

**THE OPEN UNIVERSITY OF TANZANIA**